IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Inventor(s):	Joseph Carmine Centanni et al.		
Case:	Centanni 2-32-9-22-5-7 (LCNT/126046)		
Serial No.:	10/734,803	**Group Art Unit:**	2613
Filed:	December 12, 2003	**Confirmation #:**	3519
Examiner:	Curs, Nathan M.		
Title:	METHOD AND APPARUTUS FOR MULTI-BAND OPTICAL SWITCHING USING MULTI-PUMP PARAMETRIC DEVICES		

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SIR:

APPEAL BRIEF

Appellants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 2613 mailed March 31, 2008 finally rejecting claims 1-2, 4, 8-10, 14-20.

In the event that an extension of time is required for this appeal brief to be considered timely, and a petition therefor does not otherwise accompany this appeal brief, any necessary extension of time is hereby petitioned for.

Appellants believe the only fee due is the $510 Appeal Brief fee which is being charged to counsel's credit card. In the event Appellants are incorrect, the Commissioner is authorized to charge any other fees to Deposit Account No. 20-0782/**LCNT/126046**.

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Real Party in Interest

The real party in interest is LUCENT TECHNOLOGIES INC.

Related Appeals and Interferences

Appellants assert that no appeals or interferences are known to Appellants, Appellants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-21 and 24 are pending in the application. Claims 1-21 were originally presented in the application. Claims 22-24 were added by amendment. Claims 3, 10, 14 and 18-20 have been amended. Claims 22-23 were cancelled. Claims 3, 5-7, 11-13, and 21 are objected to as being dependent upon a rejected base claim. Claim 24 is allowed. The final rejection of claims 1 – 2, 4, 8 – 10, and 14 – 20 is appealed.

Status of Amendments

All claim amendments have been entered.

Summary of Claimed Subject Matter

Embodiments of the present invention are generally directed to an optical switch and associated method of optical switching. In one embodiment, the optical switch includes a first optical coupler, a second optical coupler, a non-linear optical element, and at least one optical splitter. The first optical combiner is for combining at least two optical pump signals to produce a combined pump signal. The second optical combiner is for combining an input data signal with the combined pump signal to produce a combined signal. The non-linear optical element is for imparting a non-linear effect on the combined signal to generate a number of optical bands based on a simultaneous three-signal interaction of the at least two optical pump signals and the input data signal. The at least one optical splitter is for separating the combined signal from the non-linear optical element into respective generated optical bands. At least one of the at least two optical pump signals is controllably modulated such that a logic sequence of the input data signal is controllably switched.

For the convenience of the Board of Patent Appeals and Interferences, Appellants' independent claims 1 and 18 are presented below with citations to various figures and appropriate citations to at least one portion of the specification for elements of the appealed claims.

Claim 1 positively recites (with reference numerals, where applicable, and cites to at least one portion of the specification added):

> 1. (previously presented) An optical switch (100), comprising:
>
> a first optical combiner (130_1) for combining at least two optical pump signals (P_1, P_2) to produce a combined pump signal, and a second optical combiner (130_2) for combining an input data signal with the combined pump signal to produce a combined signal;
>
> a non-linear optical element (120) for imparting a non-linear effect on the combined signal to generate a number of optical bands based on a simultaneous three-signal interaction of the at least two optical pump signals (P_1, P_2) and the input data signal; and

at least one optical splitter (130_3, 130_4, 130_5) for separating the combined signal from said non-linear optical element into respective generated optical bands;

wherein at least one of said at least two optical pump signals (P_1, P_2) is controllably modulated such that a logic sequence of said input data signal is controllably switched.

Support for the elements of claim 1 can be found at least from the following sections of Appellants' specification: Pg. 5, Line 9 – Pg. 6, Line 8; Pg. 6, Lines 20 – 30; Pg. 6, Line 31 – Pg. 7, Line 11; Pg. 7, Lines 24 -33; Pg. 8, Lines 11 – 17; Pg. 9, Lines 2 – 10; Pg. 11, Line 18 – Pg. 12, Line 16.

Claim 18 positively recites (with reference numerals, where applicable, and cites to at least one portion of the specification added):

18. (previously presented) A method of optical switching using a fiber parametric device having at least two optical pump sources (P_1, P_2), comprising:

combining a signal from each of said at least two optical pump sources (P_1, P_2) in a first combiner (130_1) to produce a combined pump signal, and combining (130_2) the combined pump signal with an input data signal to produce a combined signal;

imparting a non-linear effect (120) on the combined signal to generate a number of optical bands based on a simultaneous three-signal interaction of the two optical pump signals (P_1, P_2) and the input data signal; and

controllably modulating at least one of said at least two optical pump sources (P_1, P_2) such that a logic sequence of said input data signal is controllably switched.

Support for the elements of claim 18 can be found at least from the following sections of Appellants' specification: Pg. 5, Line 9 – Pg. 6, Line 8; Pg. 6, Lines 20 – 30;

Pg. 6, Line 31 – Pg. 7, Line 11; Pg. 7, Lines 24 – 33; Pg. 8, Lines 11 – 17; Pg. 9, Lines 2 – 10; Pg. 11, Line 18 – Pg. 12, Line 16.

Grounds of Rejection to be Reviewed on Appeal

Claims 1-2, 4, 8-10, 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takeda et al. (U.S. Patent No. 6424774, hereinafter "Takeda") in view of Bjarklev et al. (U.S. Patent Application Publication No. 2004/0100681, hereinafter Bjarklev) and further in view of Cearns et al. (U.S. Patent No. 5,943,149, hereinafter Cearns).

Arguments

Rejection Under 35 U.S.C. §103(a)

Claims 1-2, 4, 8-10, 14-20

Claims 1-2, 4, 8-10, 14-20 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takeda in view of Bjarklev and further in view of Cearns. The Appellants respectfully traverse the rejection.

Takeda, Bjarklev, and Cearns, alone or in combination, fail to teach or suggest Appellants' claim 1, as a whole. Specifically, Takeda, Bjarklev and Cearns, alone or in combination, fail to teach or suggest at least the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

In general, Takeda discloses a tunable wavelength four light wave mixer. As disclosed in Takeda, the mixer includes a dispersion-shifted optical fiber supplied with signal light from an input optical fiber and with pump light from a pump light source through a wave multiplexing unit. (Takeda, Abstract).

Takeda, however, fails to teach or suggest at least the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

In the Final Office Action, dated March 31, 2008, the Examiner asserts that the selector 27 depicted in Figure 3 of Takeda discloses Appellants' limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1. Appellants respectfully disagree.

As described in Takeda, selector 27 does not perform modulation of the pump signals λ_{p1} and λ_{p2} from respective pump sources 22-1, 22-2; rather, selector 27 performs selection between the pump signals λ_{p1} and λ_{p2} from respective pump sources 22-1, 22-2. Specifically, with respect to selector 27, Takeda states that "...pump light sources 22-1,

22-2 of wavelengths λ_{p1}, λ_{p2} are selected by selector 27...." (Takeda, Col. 4, Lines 53-54, Emphasis added). In other words, Takeda discloses selection between pump signals λ_{p1} *or* λ_{p2}, not modulation of the pump signals λ_{p1} and λ_{p2}, and, thus, fails to teach or suggest the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

Additionally, in the Final Office Action, dated March 31, 2008, the Examiner cites a specific portion of Takeda (namely, Col. 5, Line 6 – 22), asserting that the cited portion of Takeda discloses Appellants' limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1. Appellants respectfully disagree.

The cited portion of Takeda is devoid of any teaching or suggestion of controllably modulating at least one of at least two pump signals such that a logic sequence of an input data signal is controllably switched. Rather, the cited portion of Takeda merely describes a scenario in which the pump light of wavelength λ_{p2} is selected by selector 27 and, further, states that "...by selectively switching the pump light under the control of selector 27, the signal light of wavelength λ_s can be output as a converted light of wavelength λ_{c1} or λ_{c2}." (Takeda, Col. 5, Lines 6 – 22, Emphasis added). In other words, Takeda merely discloses that selector 27 performs selection between the pump signals λ_{p1} and λ_{p2} from respective pump sources 22-1, 22-2. The cited portion of Takeda fails to teach or suggest controllably modulating at least one of at least two pump signals such that a logic sequence of an input data signal is controllably switched, as claimed in Appellants' claim 1.

Therefore, Appellants respectfully submit that Takeda does not teach or suggest the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

Furthermore, Appellants note that the selection between pump sources of wavelengths λ_{p1} *or* λ_{p2} in Takeda is based on one or the other pump source corresponding with the respective zero dispersion wavelengths of optical fibers 21-1 or 21-2 (Takeda,

Col. 4, Lines 49-57) as a necessary component of achieving the phase matching and, thus, mixing toward which Takeda is directed. Therefore, having both pump sources of wavelengths λ_{p1} *or* λ_{p2} of Takeda active at any given time would be contrary to the collective principles of Takeda. Thus, the Appellants respectfully submit that, not only does Takeda fail to teach or suggest the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," but Takeda actually teaches away from this limitation of Appellants' claim 1.

Thus, at least for these reasons, Takeda fails to teach or suggest at least the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

Furthermore, Bjarklev and Cearns, alone or in combination, fail to bridge the substantial gap between Takeda and Appellants' claim 1.

In general, Bjarklev discloses an optical wavelength conversion device. As disclosed in Bjarklev, the conversion device includes a micro-structured optical waveguide including sections with a non-linear material having an index of refraction which changes as a non-linear function of light intensity. (Bjarklev, Abstract).

In general, Cearns discloses an optical demultiplexor having a narrow band filter for separating a narrow band channel prior to utilizing one or more wide band filters for separating a plurality of channels into groups of channels. (Cearns, Abstract).

Bjarklev and Cearns, alone or in combination with each other and/or Takeda, fail to teach or suggest Appellants' claim 1, as a whole. Namely, Bjarklev and Cearns, alone or in combination with each other and/or Takeda, fail to teach or suggest at least the limitation of "at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

Appellants respectfully note that no arguments have been put forth in any of the Office Actions suggesting that Bjarklev and/or Cearns teaches or suggests, or can be combined with Takeda to arrive at, the claimed limitation of "at least one of said at least

two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched," as claimed in Appellants' claim 1.

Thus, at least for these reasons, Appellants respectfully submit that Takeda, Bjarklev, and Cearns, alone or in combination, fail to teach or suggest Appellants' claim 1, as a whole.

Additionally, in the Advisory Action, dated June 18, 2008, the Examiner states that "Takeda's selecting between pump signals reads on modulating each of those pump signals because they are each being controllably passed or blocked by the selector switch; each pump signal is thus being amplitude modulated between full and zero amplitude." Appellants respectfully disagree. Appellants respectfully note that the Examiner's argument fails to address the full limitation of Appellants' claim 1. Namely, the Examiner fails to address the portion of Appellants' claim 1 that state that at least one of the at least two optical pump signals is controllably modulated such that a logic sequence of the input data signal is controllably switched. Thus, even assuming that the portion of Takeda cited by the Examiner could be interpreted as disclosing modulation of the two pump signals (which Appellants maintain it cannot), Takeda would still fail to teach or suggest that the pump signals are modulated such that a logic sequence of the input data signal is controllably switched, as claimed in Appellants' claim 1.

Furthermore, in the Advisory Action, dated June 18, 2008, the Examiner attempts to refute Appellants' argument that Takeda teaches away from the modulation limitation of Appellants' claim 1 by stating that Appellants' argument ignores the contribution of Bjarklev since Takeda's alternating pump does not teach away from adding a third and different pump signal. (Advisory Action, Pg. 2). In response, Appellants respectfully note that the argument that Takeda teaches away from the modulation limitation of Appellants' claim 1 does not ignore the contribution of Bjarklev. Rather, the contribution of a third pump from Bjarklev (assuming that Bjarklev supports a third pump signal) is irrelevant within this context since Takeda clearly teaches selection between pump signals such that only one pump signal is applied at a time. As such, addition of a third pump signal based on teachings of Bjarklev (assuming that Bjarklev supports a third pump signal) would merely result in a system in which the selector of Takeda chooses one of three available pump signals and, thus, the combination of Takeda and Bjarklev

(assuming such combination is even possible) would still teach away from the modulation limitation of Appellants' claim 1.

As such, at least for the reasons stated herein, Appellants respectfully submit that independent claim 1 is patentable over Takeda in view of Bjarklev and Cearns under 35 U.S.C. §103.

Similarly, independent claim 18 recites relevant limitations similar to those recited in independent claim 1 and, therefore, for at least the same reasons discussed above with respect to claim 1, claim 18 also is patentable over Takeda in view of Bjarklev and Cearns under 35 U.S.C. §103.

Furthermore, since all of the dependent claims that depend from the independent claims include all the limitations of the respective independent claim from which they ultimately depend, each such dependent claim also is patentable over Takeda in view of Bjarklev and Cearns under 35 U.S.C. §103.

Therefore, Appellants respectfully request that the rejection be withdrawn.

Conclusion

Thus, Appellants submit that all of the claims presently in the application are allowable.

For the reasons advanced above, Appellants respectfully urge that the rejection of claims 1-2, 4, 8-10, 14-20 is improper. Reversal of the rejections of the Final Office Action is respectfully requested.

Respectfully submitted,

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CLAIMS APPENDIX

1. (previously presented) An optical switch, comprising:

a first optical combiner for combining at least two optical pump signals to produce a combined pump signal, and a second optical combiner for combining an input data signal with the combined pump signal to produce a combined signal;

a non-linear optical element for imparting a non-linear effect on the combined signal to generate a number of optical bands based on a simultaneous three-signal interaction of the at least two optical pump signals and the input data signal; and

at least one optical splitter for separating the combined signal from said non-linear optical element into respective generated optical bands;

wherein at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched.

2. (original) The optical switch of claim 1, further comprising at least two optical pump sources, each of said sources providing one of said at least two optical pump signals, wherein at least one of said at least two optical pump sources is adapted to controllably modulate its respective optical signal such that a logic sequence of said input data signal is controllably switched and an output signal of said optical switch comprises a multi-band switched optical signal.

3. (previously presented) The optical switch of claim 1, wherein said input data signal has a frequency that is substantially equal to an average of respective frequencies of said at least two optical pump sources.

4. (original) The optical switch of claim 2, further comprising a controller for controlling the modulation of the at least one modulated optical pump source.

5. (original) The optical switch of claim 2, wherein one of said at least two optical pumps is modulated and all other optical pumps are maintained constant.

6. (original) The optical switch of claim 5, wherein a resulting multi-band switched output signal is substantially a Boolean AND combination of the logic sequence of said input data signal and the logic sequence of said modulated optical pump signal.

7. (original) The optical switch of claim 5, further comprising a variable delay line for synchronizing the input data signal and the modulated optical pump.

8. (original) The optical switch of claim 1, wherein said non-linear optical element comprises a highly non-linear fiber.

9. (original) The optical switch of claim 1, wherein said non-linear optical element generates a parametric amplification of the combined signals.

10. (previously presented) The optical switch of claim 9, wherein said non-linear effect comprises difference frequency generation.

11. (original) The optical switch of claim 9, wherein an output of said optical switch comprises a replica of said input data signal and at least three idler signals.

12. (original) The optical switch of claim 11, wherein said at least three idler signals comprise at least two mirrored idler signals and at least one translated idler signal.

13. (original) The optical switch of claim 12, wherein said mirrored idler signals comprise input data signal conjugates.

14. (previously presented) The optical switch of claim 9, wherein each wavelength of said input data signal is converted into a corresponding wavelength in said respective generated optical bands.

15. (original) The optical switch of claim 2, wherein said optical pump sources comprise laser sources.

16. (previously presented) The optical switch of claim 1, wherein each of said first and second optical combiner comprises a band splitter.

17. (original) The optical switch of claim 1, wherein said at least one optical splitter comprises a band splitter.

18. (previously presented) A method of optical switching using a fiber parametric device having at least two optical pump sources, comprising:

combining a signal from each of said at least two optical pump sources in a first combiner to produce a combined pump signal, and combining the combined pump signal with an input data signal to produce a combined signal;

imparting a non-linear effect on the combined signal to generate a number of optical bands based on a simultaneous three-signal interaction of the two optical pump signals and the input data signal; and

controllably modulating at least one of said at least two optical pump sources such that a logic sequence of said input data signal is controllably switched.

19. (previously presented) The method of claim 18, further comprising separating said generated optical bands using one or more band splitters.

20. (previously presented) The method of claim 19, wherein said non-linear effect generates a parametric amplification of said combined signal such that an output of said fiber parametric device comprises one or more switched optical signals corresponding to one or more of the generated optical bands.

21. (original) The method of claim 20, wherein the output of said fiber parametric device comprises at least a replica of said input data signal and three distinct idler bands.

22-23. (canceled)

24. (previously presented) An optical switch, comprising:

a first optical combiner for combining at least two optical pump signals to produce a combined pump signal, and a second optical combiner for combining an input data signal with the combined pump signal to produce a combined signal;

a non-linear optical element for imparting a non-linear effect on the combined signal; and

at least one optical splitter for separating the combined signal from said non-linear optical element into respective generated optical bands;

wherein at least one of said at least two optical pump signals is controllably modulated such that a logic sequence of said input data signal is controllably switched; and

wherein said input data signal has a frequency that is substantially equal to an average of respective frequencies of said at least two optical pump sources.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None